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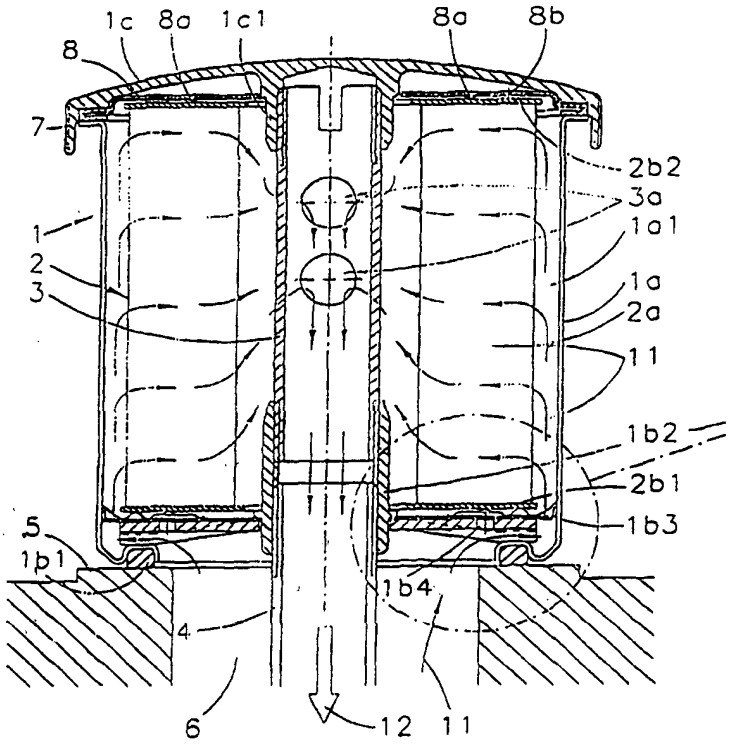
(54) Title: ARRANGEMENT IN AN OIL FILTER

(57) Abstract

The invention relates to an arrangement in an oil filter (1) for a machine with a centralised lubrication system, for example an internal combustion engine. The oil filter comprises a cylindrical container (1a) containing a filter material (2). One end (1b) of the container has a peripheral seal (1b1), a central, threaded sleeve (1b2) serving as outlet for oil that has passed through the oil filter, and inlet openings (1b3) situated between the sleeve (1b2) and the seal (1b1) for oil that is to be filtered. When the filter (1) is fitted to the machine it forms part of the machine lubrication system. Connected to the inlet and outlet of the oil filter is a non-return valve, designed to retain the oil in the container (1a) when the oil pressure is cancelled, together with an overflow valve designed to open and allow at least some of the incoming oil to bypass the filter material (2) when the fall in pressure over the said material exceeds a predetermined pressure value. When changing the filter material, the other end serves as an openable/closeable cover. The non-return valve is designed to be acted upon by the force of a spring, prevailing when the cover (1c) is closed, to maintain its non-return valve function and to open when the spring force is cancelled as a result of the cover (1c) being opened.



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Arrangement in an oil filter

The present invention relates to an arrangement in an oil filter according to the pre-characterising part of claim 1.

The purpose of such an oil filter is to trap particles in the lubricating oil in order thereby to prevent unnecessary wear in the crank bearings, valve timing gear and other moving parts of an internal combustion engine.

In the case of motor vehicle engines this generally involves replaceable, disposable filters comprising a paper-metal filter enclosed in a crimped metal casing, preferably of sheet steel. Such a filter is screwed on to an inlet pipe, projecting from the engine block, for the oil that has been cleaned in the filter. Around the said pipe the engine block has a raised shoulder, against which the filter seal seals off incoming oil that flows into the filter via one or more ports in the engine block, which are situated between the outlet pipe and the sealed shoulder.

The function of the non-return valve in the form of a sprung rubber lip, referred to in the pre-characterising part of claim 1, is to prevent oil flowing back to the engine's oil sump when the engine is switched off. This is desirable in order that the oil filter be largely filled with oil, so that the engine lubrication points will be supplied with oil as soon as possible on restarting the engine, that is to say without first waiting for the oil filter and the oil ducts situated downstream of the latter to refill.

The function of the overflow valve likewise referred to in the pre-characterising part of claim 1 is to allow the oil to bypass the filter if the fall in pressure over the said filter exceeds a certain value.

When the oil filter is to be changed after the prescribed interval, it is filled with contaminated oil owing to the function of the non-return valve. Handling the said used oil filters presents a number of awkward problems.

In practice, used oil filters cannot be burned, since they are unsuitable from the combustion point of view and the end products, possibly with heavy metal residues, would be steel containers, not readily oxidizable, which are unattractive from the point

of view of recycling, since they have a low recycling value and a large transport volume.

Attempts have been made to improve the waste treatment by pressing the oil out of the filter container, thereby making it easier to burn, but leaving from each filter a compressed steel body with oil residues that is unsuitable for treatment in a metallurgical recycling process and makes environmental long-term tipping virtually unfeasible.

The object of the present invention is to produce an oil filter of the type initially referred to, in which the filter container lasts for the life-span of the engine and the fibre material is changed, oil in the filter container being automatically drained in conjunction with a change of filter material, so that only a small quantity of oil will be present in the used filter material.

This object is achieved in that the filter possesses the features described in the characterising part of claim 1.

Advantageous details of the invention are set out in the subordinate claims and in the following description of one embodiment with reference to the attached drawings in which:

Figure 1a in a longitudinal section shows an embodiment of an oil filter according to the invention and the oil flow through this in normal operation. Figure 1b shows a detailed view on an enlarged scale of the filter according to figure 1a. Figure 2a shows the function in an overflow valve and the overflow in the filter when this opens. Figure 2b shows the overflow valve and its function in detail. Figure 3a illustrates changing of the filter material and figure 3b is a detailed view showing how, according to the invention, the function of the non-return valve is cancelled when the cover of the oil filter is opened.

In the drawing, the figure 1 generally denotes an oil filter according to the invention. This comprises a container 1 with a cylindrical wall 1a and two ends 1b and 1c, together with a filter material 2 enclosed by the container 1. The end 1b has a peripheral seal 1b1 and a sleeve 1b2 is arranged centrally in the end. Between the said sleeve and the seal 1b1, more precisely up to the container wall 1a, there are openings 1b3 in the end 1b. Between the ends 1b, 1c a central tube 3 is arranged with a number of openings 3a in the circumferential surface. The tube 3 is screwed into the sleeve 1b2. The openings 1b3 are

inlet openings for the oil that is to be cleaned and they lead the oil to a space 1a1 between the container wall 1a and the filter material 2. From this space the oil flows through the filter material and is caught by the openings 3a in the tube 3, through which the oil runs to the sleeve 1b2, which forms an outlet opening for the filter 1.

When the oil filter is fitted to an internal combustion engine, for example, the sleeve 1b2 is joined by means of a threaded connection to an inlet pipe 4 projecting from the engine, and the seal 1b1 bears tightly against a raised shoulder 5 on the engine block. Oil to be filtered flows through a duct 6, which surrounds the inlet pipe 4 and connects with the engine lubrication points.

As initially stated, conventional oil filters have a non-return valve function and an overflow valve function. These functions are also encountered in the filter according to the invention, as will be seen from the following.

The filter 2 takes the form of a relatively thick-walled tube, the wall 2a of which is composed of folded paper and at the extremities of which there are ends in the form of a plane, annular plate 2b1, 2b2 of a stiff material, for example light metal, plastic or plastic-impregnated paper.

In order to facilitate changing of the filter, the second end 1c of the filter container is formed as an openable/closeable cover. For this purpose the cover 1c is provided with a central threaded sleeve 1c1, which can be screwed on to the end of the tube 3. Between the cover 1c and the container 1a there is a seal 7. This is fixed over the periphery of a plate spring 8, which with a groove 8a remote from the cover 1c is intended to press against the end 2b2 of the filter material 2a. The function of the spring 8 will be explained below.

According to the invention the non-return valve in the present oil filter is designed to maintain its non-return valve function while ever the cover 1c is fitted, but when it is removed the non-return valve function is cancelled, which means that the filter container 1 is drained of oil.

In the embodiment of the invention shown in the drawing both the non-return valve function and the overflow valve function are accomplished essentially by a single component, namely an annular, spring diaphragm 9 which, with an edge flange 9a gently

arched towards the cover 1b, fits against the container wall 1a in such a way that the oil can pass. As will be most clearly seen from the detailed views in figures 1b, 2b and 3b, the diaphragm 9, working from the outer edge flange 9a, has four concentric grooves 9b, 9c, 9d and 9e. The grooves 9b and 9c point towards the end 1b and are designed to bear against the annular plate 1b. The groove 9d, which also points towards the end 1b, is situated at a certain distance from the groove 9c and closer to the centre than the latter, and the groove 9e, which points towards the annular plate 1b, is situated even closer still to the centre than the groove 9c and at a certain distance from the latter. In the annular plate 1b, essentially right below the groove 9d, there are through-holes 1b4. The diaphragm 9 is formed so that, unaffected by external forces and with the grooves 9b, 9c resting on the annular plate 1b, an annular gap 10 (see figure 3b) is formed between the plate 1b and the groove 9e, though which gap oil can flow out via the holes 1b4 to the outlet sleeve 1b2. The gap 10, however, is closed when the diaphragm is acted upon by a sufficiently large force directed downwards, which is transmitted via the filter material 2, more precisely from the cover 1c, which acts on the plate spring 8, which by way of the groove 9a presses again the end 2b1 so that finally the end 2b2 presses against the groove 9d and so that the groove 9c comes to bear against the annular plate 1b, thereby creating the non-return valve function.

The overflow valve function is produced by appropriate balancing between the force from the plate spring 8 on the one hand and the spring rigidity of that area of the diaphragm 9 lying between the grooves 9d and 9e and the oil pressure on the other. This balance is designed so that at a predetermined pressure oil can flow out through an annular gap, which occurs between the groove 9e and the annular plate 1b, as shown in figures 3a, 3b, and explained in more detail below.

In figures 1a, 1b the oil flow into and through the oil filter is indicated by arrows 11 and the oil's path out of the filter in normal operation by an arrow 12. As the arrows 11 show, the oil flows up through the duct 6 and into the filter itself via the openings 1b3, where the oil, distributed throughout the space 1a1, continues through the filter material 2a towards the tube 3 and in through openings 3a, before reaching the engine inlet pipe 4 via the said openings.

Should the fall in pressure over the filter material now exceed a predetermined value for any of the reasons already described or any combination thereof, the overflow valve opens, as shown in figures 2a and 2b, so that the total oil flow through the filter is kept

essentially constant. The flow through the overflow valve, which represents the quantity of oil that has not passed through the filter material, is indicated in figures 2a, 2b by the arrows 13. The remainder of the total flow flows as shown in figure 1 and has, for the sake of simplicity, been omitted in figures 2a, 2b. When it is time to change the filter material it is assumed that the engine is not in operation and that consequently there is no oil pressure or oil flow, but for the reasons indicated earlier the filter container is filled with oil. This is automatically drained off, however, by means of the arrangement according to the invention, as will be explained in connection with figures 3a, 3b.

When the cover was screwed off and the filter material 2 removed from the filter container 1, the force acting on the diaphragm 9, which originates from the plate spring 8 and the weight of the filter material 2, has also been cancelled, thereby cancelling the non-return valve function of the diaphragm by way of its springing. The oil in the container can now flow out, as indicated by arrows 14, via the annular gap between the groove 9e and the annular plate 1b and the through-openings 1b4 in the latter down into the duct 6. When the filter container has been drained, fresh filter material can be inserted into the container 1a and the cover screwed on, following which the engine can be started.

In the plate spring 8 there is a pressure equalisation opening 8b, the function of which is to produce the same pressure on both sides of the plate spring 8. This eliminates the risk of jeopardising the non-return valve function as a result of different pressures on both sides of the plate spring 8. If, in fact, the pressure above the plate spring were sufficiently lower than that below it, the plate spring would be prevented from producing a downward spring force and the non-return valve function would be cancelled.

Claims

1. Arrangement in an oil filter (1) for a machine with a centralised lubrication system, for example an internal combustion engine, comprising a cylindrical container (1a) containing a filter material (2), one end (1b) of the container having a peripheral seal (1b1), a central, threaded sleeve (1b2) serving as outlet for oil that has passed through the oil filter, and inlet openings (1b3) situated between the sleeve (1b2) and the seal (1b1) for oil that is to be filtered, the filter (1) being fitted to the machine as part of the machine lubrication system, and a non-return valve being provided in connection with the oil filter inlet and outlet that is designed to retain the oil in the container (1a) when the oil pressure is cancelled, together with an overflow valve designed to open and allow at least some of the incoming oil to bypass, that is not flow through the filter material (2) when the fall in pressure over the said material exceeds a predetermined pressure value as a result of the oil being cold or the filter material (2) being clogged by dirt particles from the oil, **characterised in that** the second end serves, when changing the filter material, as an openable/closeable cover, known in the art, that the non-return valve is designed, when acted upon by the force of a spring, prevailing when the cover (1c) is closed, to maintain its non-return valve function and to open when the spring force is cancelled as a result of the cover (1c) being opened.

2. Arrangement according to claim 1, **characterised in that** the filter material forms an operative connection between the non-return valve and a plate spring located between the filter material and the cover (1c), the said plate spring being designed to maintain the spring force when the cover is closed, but its spring force being cancelled when the cover is opened.

3. Arrangement according to claim 1 or 2, **characterised in that** the filter material has two plane, stiff ends, that one end of the container comprises an annular plate (1b), which with an outer edge flange (1b1) is connected by frictional action to the wall (1a) of the container (1) and with its inner edge bears against the outlet sleeve (1b2), and that the overflow and non-return valves comprise an annular spring diaphragm (9), which with an outer edge flange (9a), gently arched towards the cover (1c), bears oil-tightly against the container wall (1a) and which has a number of concentric grooves (9b, 9c, 9d, 9e) such that the diaphragm (9), working from

the outer edge flange (9a), presents a first and a second groove for bearing against the annular plate (1b), a third groove (9d) at a distance from the said grooves and curved closer to the centre than to the end (1b), and a fourth groove (9e), situated even closer to the centre and curved towards the annular plate (1b), that in the annular plate (1b), at essentially the same radius from the centre as the third groove (9d), there are through-holes (1b3) and that the diaphragm (9) is formed in such a way that, unaffected by the spring force between the annular plate (1b) and the fourth groove (9e), it forms an annular gap (9) for the oil that flows out of the container (1) via the holes (1b3), but so that the gap (10) is closed in that the diaphragm is acted upon by the spring force transmitted to the third groove (9d) via the end (2b1) of the filter material (2a), thereby producing the non-return valve function, and that the overflow valve function is produced simultaneously by the springing of that part of the membrane (9) lying between the third groove (9d) and the fourth groove (9e) in that, by overcoming the said springing of the membrane (9), oil can flow through a gap between the annular plate (1b) and the fourth groove (9e).

FIG 1b

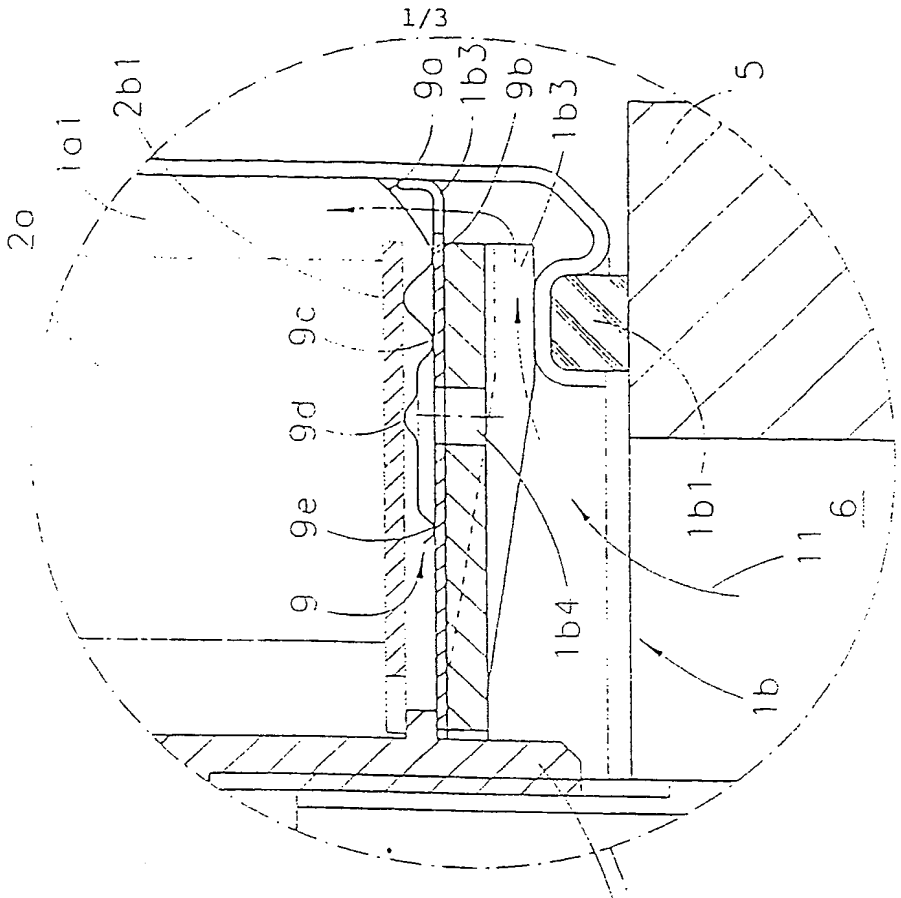
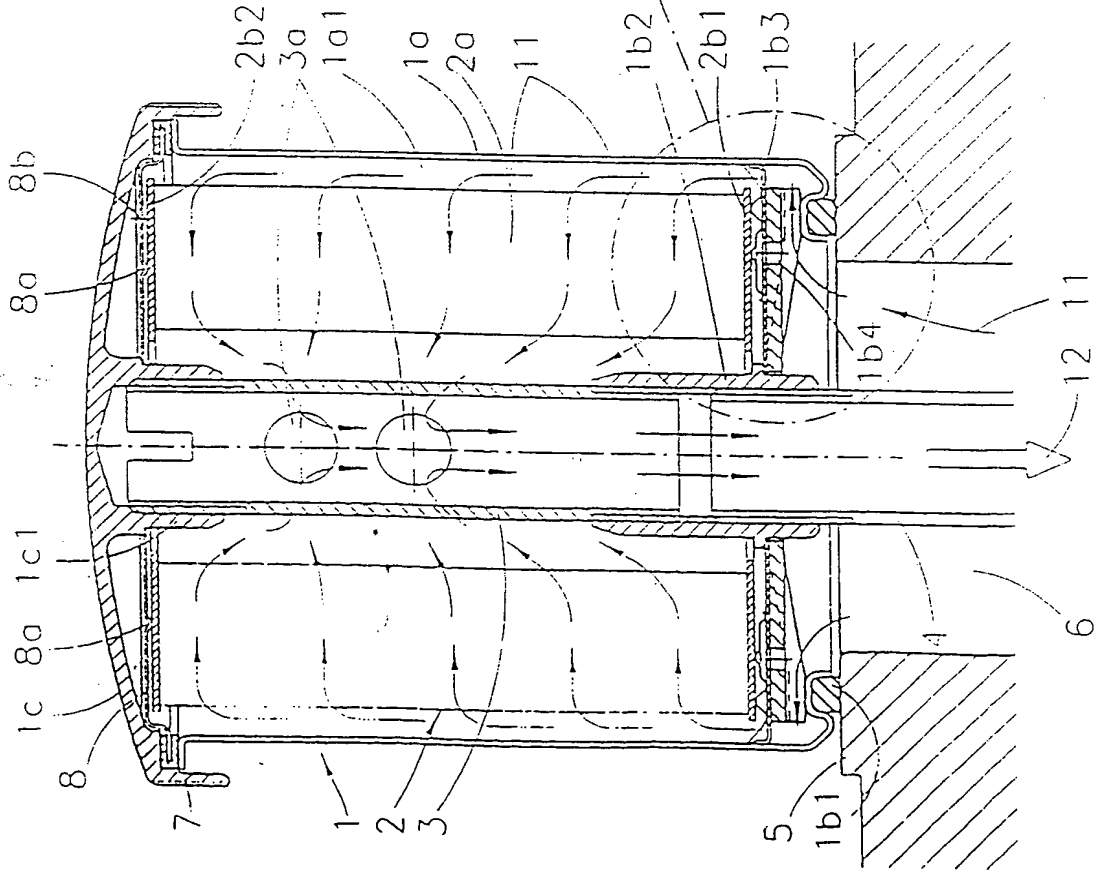

1/3
2b1
1a1
2a
9a
1b3
9b
1b3
5
9c
9d
9e
9
1b4
1b1
11
6
1b
1b2
2b1
1b3

FIG 1a


2b2
3a
1a1
1a
2a
11
8b
8a
1c1
1c
8a
8
7
1
2
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1b4
12
11
6
4
5
1b1

FIG 2b

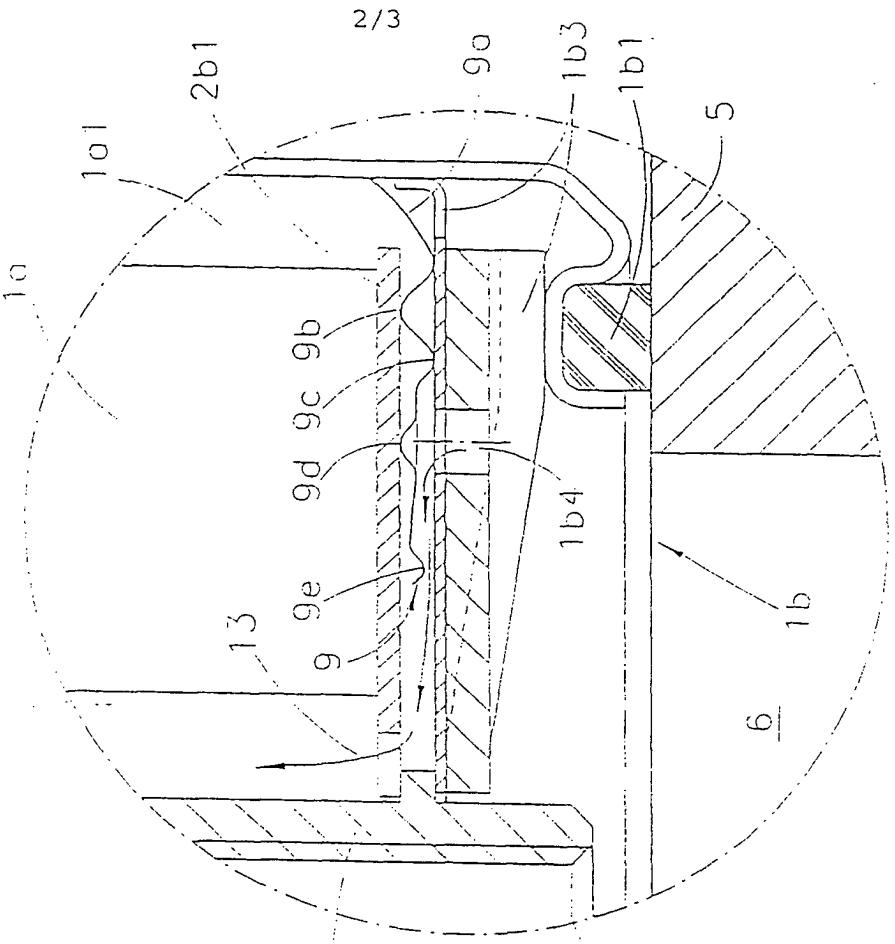
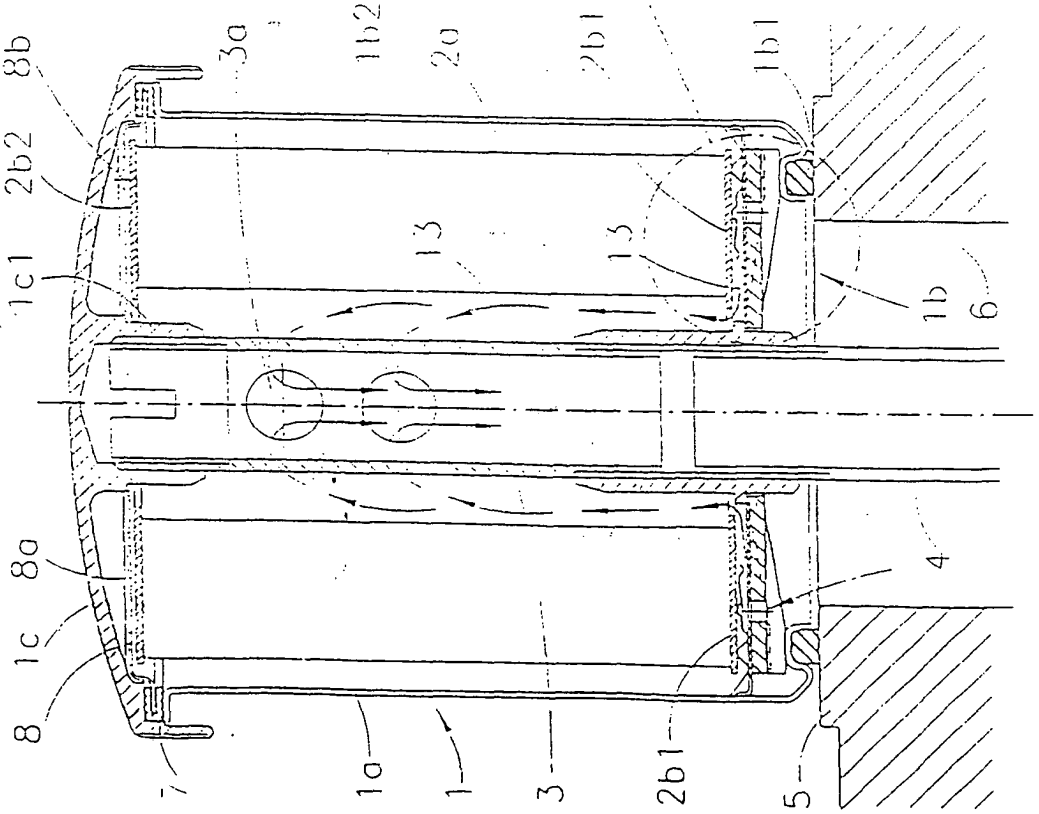

2b1
9a
1b3
1b1
5
1a1
1a
9b
9c
9d
1b4
9e
13
9
1b
6

FIG 2a


8b
3a
1b2
2a
2b1
1b1
2b2
1c1
13
13
1b
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1c
8
4
1a
1
3
2b1
5

FIG 3b

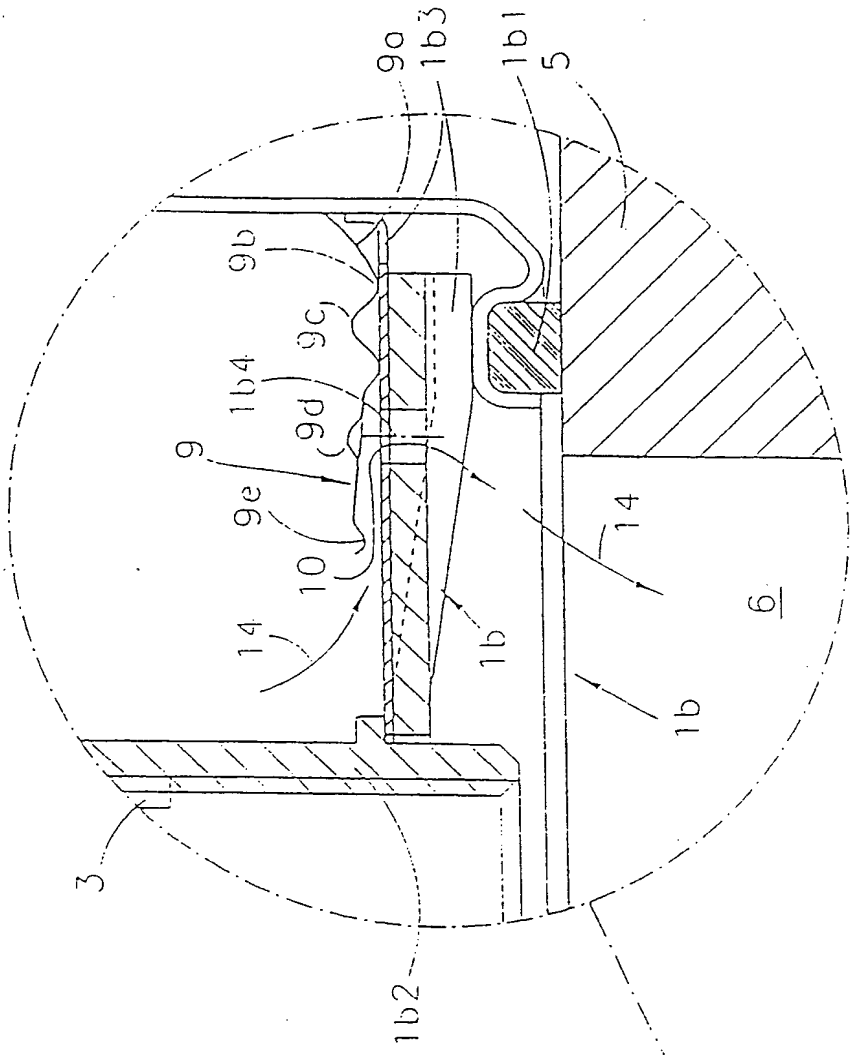
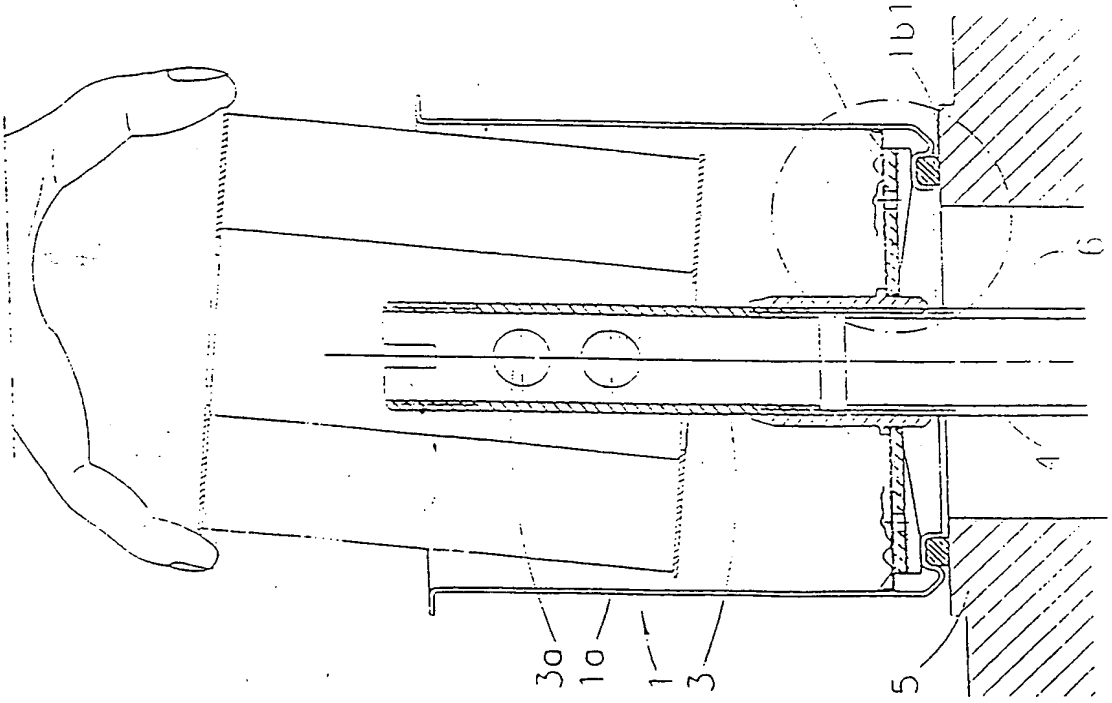


FIG 3a



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/00331

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B01D 27/08
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

01/06/99

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0681094 A1	08/11/95	GB 9408973 D	00/00/00